



**RE invest**

A ROADMAP FOR RESILIENCE  
Investing in resilience,  
reinvesting in communities.



# INTRODUCTION

Cities and communities around the world are struggling to finance and replace aging, failing, or inadequate infrastructure systems. Not only are local leaders faced with the challenge of building or rebuilding infrastructure at city-wide scales, they are being asked to do so in a time of strained public resources and greater challenges—like climate change, urbanization, shifting population demographics, and rapid technology change.

The American Society of Civil Engineers estimates that US cities need \$3.6 trillion dollars in basic infrastructure investment in the next 20 years. This estimate is just to update what cities already have—not to build the smarter, cleaner, greener, and more robust systems designed to address new challenges, like flooding, rising sea levels, heat waves, and more.

## We need to think differently about infrastructure.

The future doesn't look like the past. As budgets for public services continue to shrink, cities large and small need new approaches to providing services and investing in infrastructure upgrades that can meet the demands of the next hundred years, not only the last hundred years.

Despite these disturbing trends, there is good news. Political will and leadership abound. Cities across the world are taking charge where state and national politics are deadlocked. In the recovery from the 2008 global financial crisis, leading private sector companies and investors have expressed strong interest in reinvesting in stable assets like roads, power systems, and water infrastructure.

Most importantly, there is growing consensus that we need to act now to not only build infrastructure, but more resilient infrastructure. Still, there is a disconnect between public and private sector interest in expanding infrastructure investment.

## **Cities lack access to capital. And investors lack a clear pipeline of high-quality investable projects.**

Currently, political leaders have few incentives to take on projects whose benefits extend beyond their current political cycles. Similarly, investors lack incentives to finance large-scale projects when political turnover is predictable and investment risks are unmanageable. Leaders from both the public and private sectors have called repeatedly for new public-private partnerships. Even with these seemingly aligned goals, large projects have been few and far between and overall infrastructure investment is still lagging.

This report offers a new framework for bridging this gap. As a 2-year national effort launched with the generous support of the Rockefeller Foundation, the RE.invest Initiative tackled the problem of infrastructure predevelopment—all of the activities that go into designing and planning large-scale infrastructure projects prior to construction.

This report summarizes the outcomes of RE.invest, an 18-month predevelopment process with eight US cities and teams of leading private sector design, engineering, law, and finance experts. The results are examples of the types of projects made possible using a new framework for reimagining civic infrastructure systems to create both public value and private investment opportunities, especially for vulnerable communities.

The concepts and examples developed through RE.invest offer a new approach for public and private sector leaders to forge innovative partnerships to build resilience around the world.

# PREDEVELOPMENT

## 1. INSTIGATE

- Don't let a crisis (or the data from a crisis) go to waste.
- Don't wait for a crisis, launch a competition.
- Create early opportunities for collaboration and coalition building.
- Map out a clear destination, but don't lock into a specific route.

## 2. INVESTIGATE

- Focus on the lifeboat, not the sinking ship.
- You are here. Don't confuse baseline data with big data.
- Follow the money. Focus on current, not (only) future losses.

## 3. IDEATE

- Zoom out. Ask bigger, better, and simpler questions.
- Focus on systems, not projects.
- Open silo doors from the outside.
- Build safe spaces and jargon-free zones.

## 4. ITERATE

- Rinse and repeat.
- Let go of ideas, even good ones.

## 5. INTEGRATE

- Mind the gap. Integrate data collection into design.
- Focus on systems finance (and system integrity), not project finance.
- Build a cohort, not a committee.
- Remember, a vision is not a project (or a project pipeline), analysis is not an answer, and funding is not financing.

## 6. IMPLEMENT

- Move from political will to political wins.
- Map a clear path to procurement and construction.
- Tell a great story, because success in resilience is something that doesn't happen.

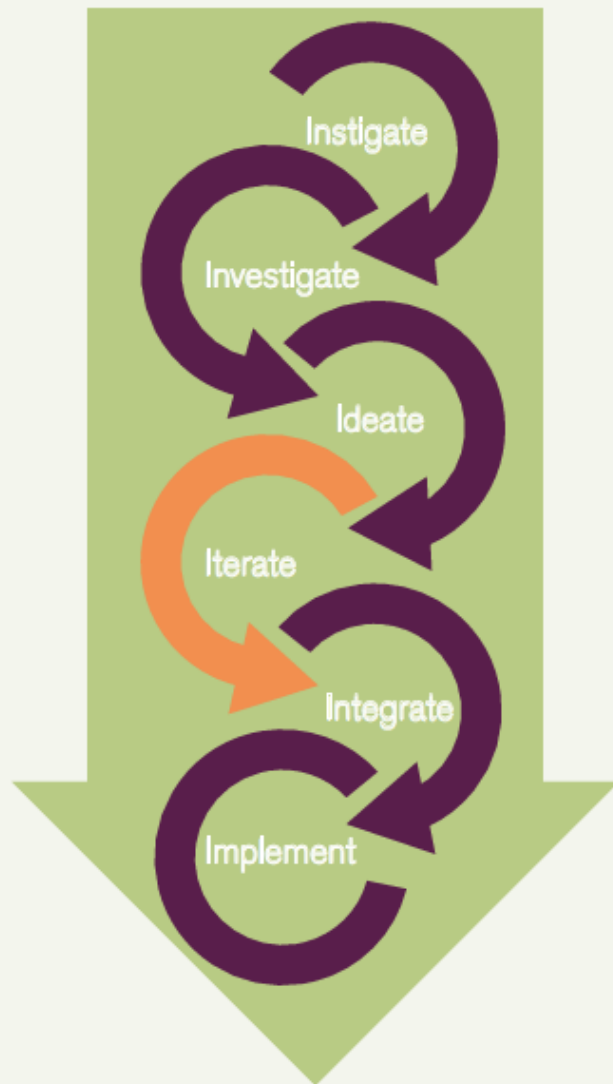
# PROCUREMENT

Figure 1: Overview of the RE.invest Process & Lessons Learned



Figure 2. Summary of Recommendations	Federal/State Government	City/Local Government	Philanthropies/Funders	Project Designers/Implementers	Investors	NGOs & Academic Institutions
Connect Predevelopment Funding Directly to Procurement	G					
Consider Options for Predevelopment Cost-Recovery	G	C	F	D		
Leverage Infrastructure Exchanges	G	C		D		
Expand Government Technical Assistance Programs to Include Outside Experts	G		F		\$	N
Create More Competitions	G		F			N
Reform Capital Planning Processes to Support Resilience Innovation		C				
Leverage Program Related Investments (PRI) for Predevelopment			F		\$	
Create “Inspiration Engines” and Support Procurement Experiments		C	F			N
Define the Project Pipeline					\$	
Design Based on Cash Flows, Not Only Costs				D		
Launch New Data Initiatives to Monetize Avoided Losses			F			N
Extend Tax-Increment Finance (TIF) to Support Private Investment in Public Goods	G	C				

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VS

Traditional Infrastructure  
Predevelopment

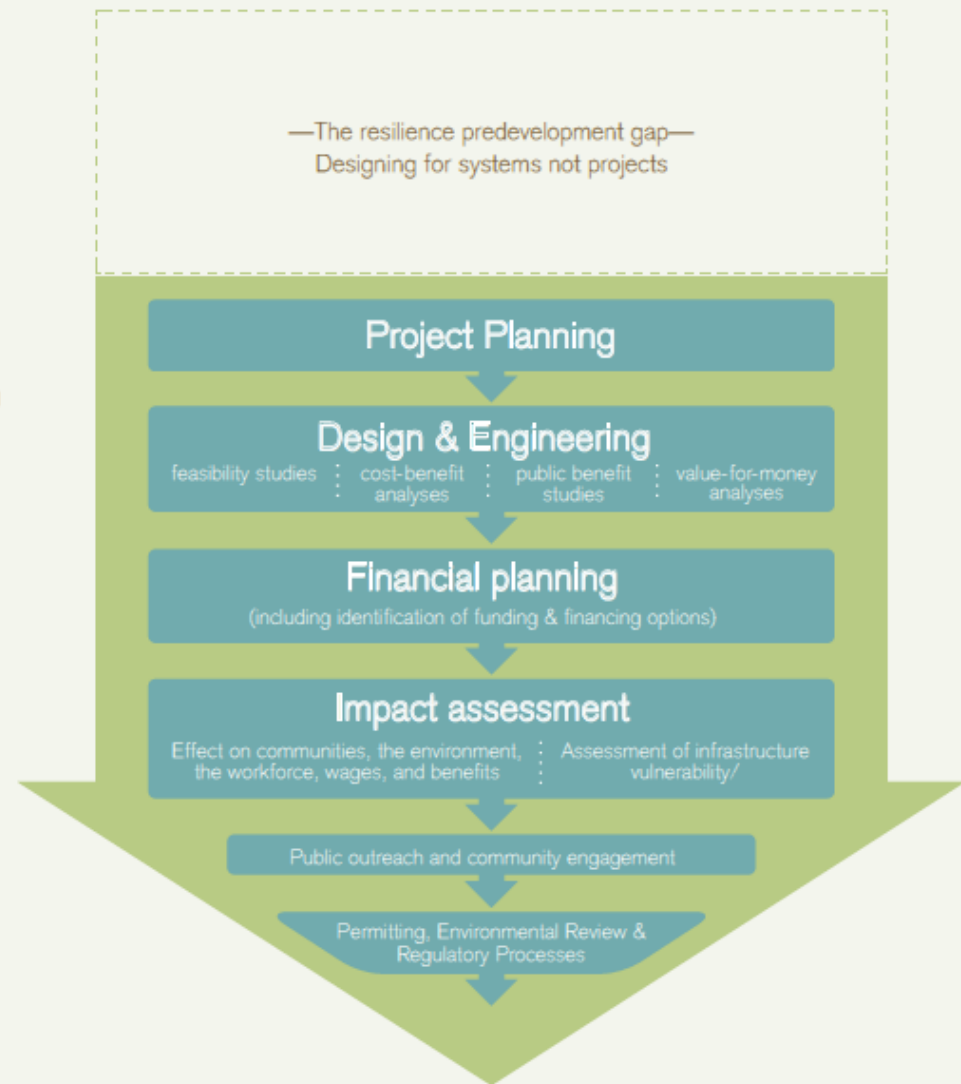


Figure 3: The RE.invest Predevelopment Process vs. Traditional Infrastructure Predevelopment

# OBJECTIVES

At a time when public resources and municipal staff are increasingly strained, the main objectives of RE.invest were to develop strategies that lessen the burdens of government, use public resources to leverage large-scale private investment, and deliver resilient infrastructure and services to underserved communities.

- **Lessen the burdens of government**

Public resources are increasingly scarce and stretched thin. As a result, local officials are often forced to be reactive rather than making integrated long-term planning decisions. RE.invest was designed to provide cities directly with much-needed technical planning and analytical support in concert with long-term funding and implementation options.

- **Mobilize private capital to protect communities**

Private investors are seeking stable large-scale investment opportunities to hedge against market volatility. RE.invest was structured to reduce transactions costs and political risk for project developers; match investors to large-scale, long-term sustainable investment opportunities; and overcome problems with project discovery, due diligence, and scale that

often undermine sustainable and resilience-focused investment opportunities.

- **Increase resilience of vulnerable cities and systems**

Taking a “systems approach” to designing and financing urban infrastructure offers a national model for resilient systems planning, delivery, and investment. The goal of RE.invest was to shape a new model for public-private partnerships that can support learning, flexibility, and continuous improvement in infrastructure delivery.

- **Improve integrated planning capacity at the municipal level**

RE.invest was designed to test and refine a template for an 18-month predevelopment process that could be applied to help cities around the world generate and implement innovative resilient infrastructure solutions. By offering cities opportunities to meet multiple needs simultaneously—such as repaving roads, expanding broadband access, and improving stormwater capture—RE.invest aimed to improve coordination and reduce competition between departments for resources and make it more cost-effective for cities to reach historically underserved, marginalized, or vulnerable communities.



- |   |   |
|---|---|
|  El Paso     |  Milwaukee     |
|  Hoboken     |  New Orleans   |
|  Honolulu    |  Norfolk       |
|  Miami Beach |  San Francisco |





# NORFOLK, VA

## FLOOD BARRIERS + GREEN INFRASTRUCTURE

**Population: 242,803 (2010 Census)**  
**Area: 54 sq. mi.**

The City of Norfolk is an independent coastal city located at the mouth of the Chesapeake Bay near the southern border of Virginia. The City of Norfolk was built on fill material and is today experiencing subsidence due to settlement and compaction. Its coastal location at the mouth of the Chesapeake Bay means that it also has to contend with projected sea level rise.



10-Year Rainfall & 10-Year Tidal Surge Event Simulation:  
The Hague (Source: Fugro, 2012)

# The Challenge

With recent increases in flooding events, projected sea-level rise, the continuation of land subsidence due to fill settlement, and the prevalence of impervious surfaces, the flooding situation in Norfolk is only expected to worsen over time.

As a result, the City's existing municipal separate storm sewer system needs additional capacity to handle current and future backwater flows caused by storm surges and high tide. This could be accomplished by either increasing the capacity of the storm drain network or by pursuing a number of green and blue infrastructure strategies to be employed throughout the City.

Norfolk identified the Arts District as an area for redevelopment that is hampered by these existing stormwater and flooding issues. Currently the Downtown Arts District is the most paved area in the municipality with many publicly and privately owned one-story warehouse-style buildings, large surface parking lots, and alleyways. The Arts District provides an opportunity for the City to test and model strategies for addressing growing flood challenges.

# Innovations

- Integrate gray and green infrastructure solutions
  - Consider how flexible flood barrier investments can be incorporated into wider redevelopment plans
  - Integrate green infrastructure into development plans and incentive programs for private developers
- Consider financing options, such as tax-increment finance (TIF), to capture real estate value increases from flood protection measures and green infrastructure upgrades
- Calculate "avoided losses" and potential financial savings due to reduced chronic flooding
- Partner with technology firms and local businesses to crowd-source data on unreported losses, such as flood damages or mold clean-up, to quantify potential savings and monetize projected benefits to accrue to residents and small businesses
- Create public programs and local competitions to encourage community-based action on a menu of green infrastructure options

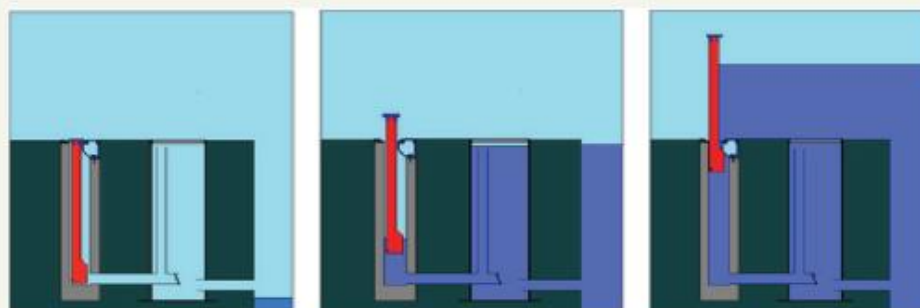


An overall map of The Hague showing the existing 100-year level of flooding is included in Figure 8. The number of structures flooded by the 100-year floodplain without the protection of the flood barrier is included for comparison purposes. The shaded blue areas indicate the extent of flooding while the pink shaded building outlines indicate flooded structures. The 100-year base flood elevation (BFE) is defined as the elevation that water is anticipated to rise to during a 100-year flood. For the City of Norfolk this elevation is 7.6 feet. The buildings indicated in red are either partially or entirely located within the 100-year flood plain. The flood barrier system being proposed within The Hague would deploy to a maximum height of 3.28 feet (100 cm). This would not provide protection from the 100-year flooding but will provide protection from more frequent smaller nuisance flooding events.

A hydraulic model was initially created in HEC-RAS to simulate the expected flooding reduction from deployment of the self-closing flood barrier. Issues encountered with the model included the lack of bathymetry data within the Hague waterfront and the complexity of the model due to the interaction of precipitation and tidal processes and inaccuracies with the area flow data. The RE.invest team overcame these issues by mapping the floodplain in GIS at incremental height increases until the team attained the maximum height proposed for the self-closing flood barrier. Using this method the team was also able to determine the number of flooded building structures with and without the self-closing flood barrier. The volume of flood water was also determined using GIS to determine the volume between the flood barrier elevation and the digital elevation model (DEM) created using the City of Norfolk GIS. A summary of protected buildings and flood volumes held back by the flood barrier during Phase 1 and Phase 2 are included in Table 2.



Figure 6: Map of The Hague Showing Proposed SCFB Location



### Self Closing Flood SCFB™

Side view working principle of the self closing flood barrier

Figure 7: SCFB Working Principle (Source: Aggeres Flood Solutions)



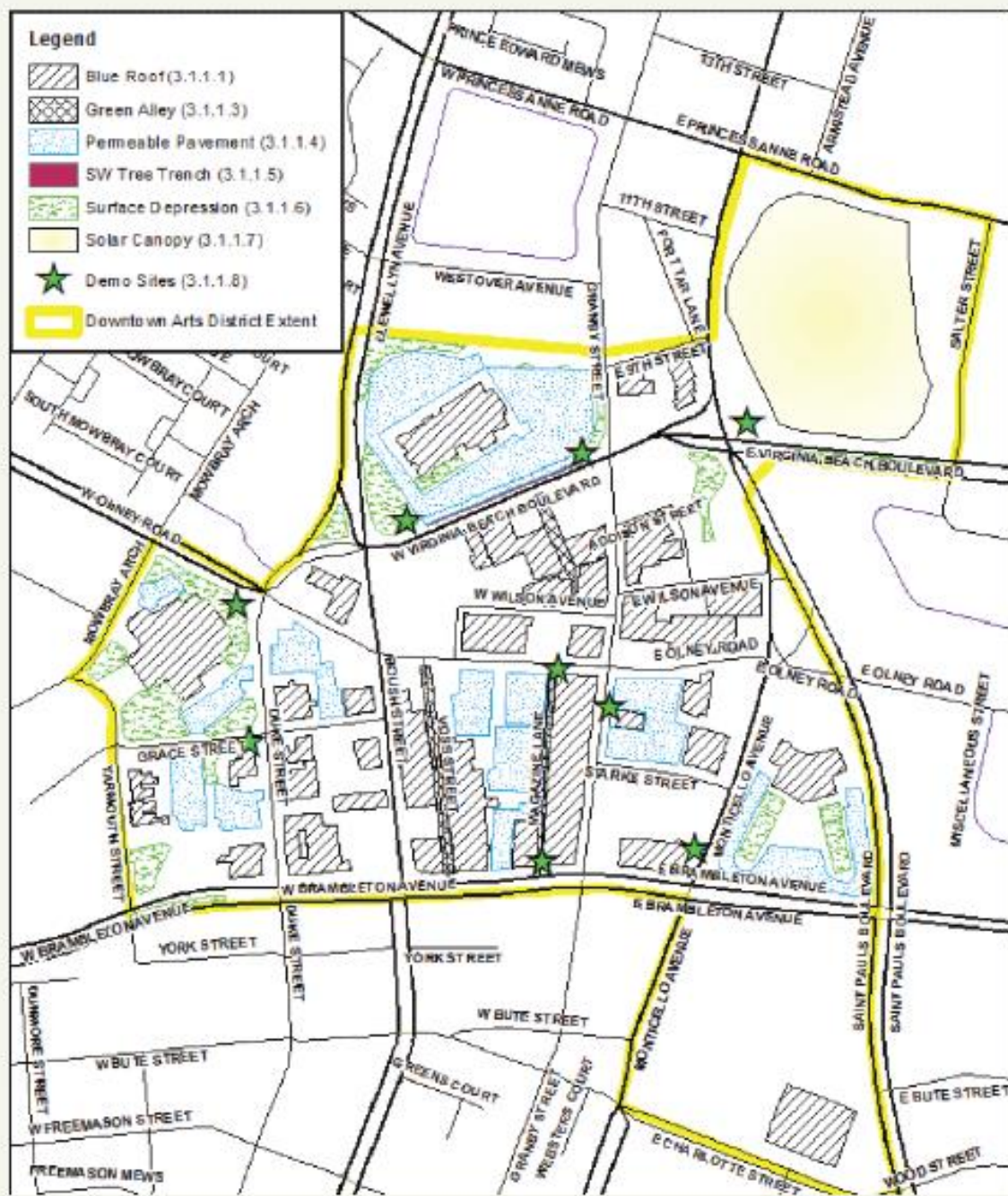


Figure 9: Green Infrastructure Location Map

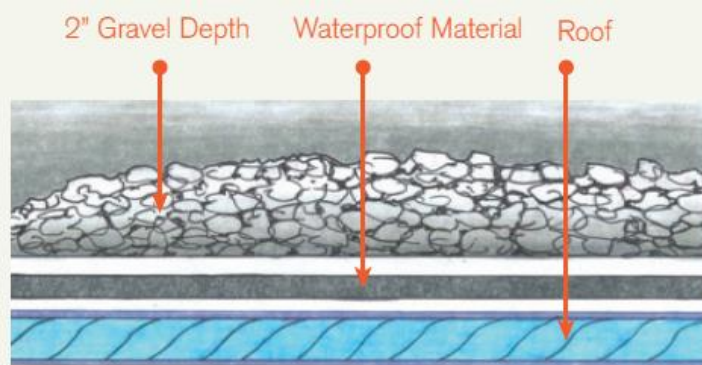


Figure 10: Typical Blue Roof Tray Section (Source: www.arcsa-edu.org)

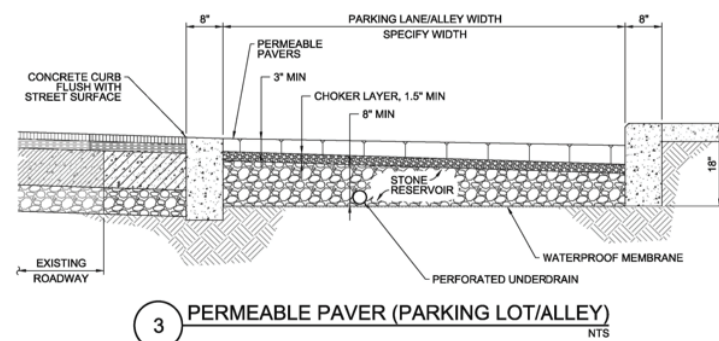


Figure 14: Stormwater Tree Trench Section (Source: PWD Green Streets Design Manual)



"Re:bound is 'the combination of a life insurance and smoking cessation program.'"

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**The RE.bound Program Leverages Innovative Risk Transfer Solutions As a Mechanism for Resilient Infrastructure Project Finance**

***A team of private sector leaders is designing and structuring new insurance-based products to generate capital for risk-reduction projects***

**New York – April 2, 2015** – Today re:focus partners is proud to announce the first step toward creating a new financial product designed to support resilient infrastructure investment. Together with The Rockefeller Foundation, Swiss Re, Goldman Sachs and RMS, re:focus partners is launching a new program called RE.bound.

Through RE.bound, a team of private sector leaders is taking steps to design a new catastrophe bond-like product that can promote project-based risk reduction solutions. These new types of instruments would realize the potential insurance benefits from infrastructure improvements and monetize the physical and financial risk reductions associated with investments in resilient systems, such as seawalls and green stormwater infrastructure.

Planning for resilience projects is a public investment challenge because the benefits are diffuse and realized far into the future. Infrastructure spending stays stuck in traditional projects when the financial benefits of resilience investments are not identified ahead of time. For example, the savings from risk mitigation efforts are rarely measured in coastal communities that don't flood regularly. RE.bound intends to fix this problem by modeling the financial benefits of specific resilient infrastructure projects upfront and integrating insurance coverage with investment in long-term risk reduction.

If this structure is viable, it will be announced at the UN Climate Change and Sustainable Development Goals conferences in Paris in December 2015.

"At The Rockefeller Foundation we recognize that in order to solve today's challenges, communities need innovative tools, such as these new bonds, that have the potential to transform how they think and operate through a resilience lens," said Judith Rodin, president of The Rockefeller Foundation. "RE.bound will use the expertise of leaders in investment banking, reinsurance, infrastructure, and climate risk analysis. We are confident that well-structured risk transfer mechanisms can both help communities recover more quickly from severe shocks and make them more resilient ahead of potential disasters."

"RE.bound is an exciting next step to our work on the [RE.invest Initiative](#)," said Shalini Vajjhala, Founder and CEO of re:focus partners. "This new program builds on the local resilient

The  Works

**NEXT  
CITY** Inspiring Better Cities.

## Here's How Hoboken Could Pay for a Giant Anti-Flooding Bathtub

BY RACHEL KAUFMAN | MAY 15, 2015



Flooded streets in the aftermath of Hurricane Sandy in Hoboken, New Jersey, which was recently named a role model of resilience. (AP Photo/Charles Sykes, File)

Recent science **argues** that humans have already pushed Earth past the safe level for carbon dioxide concentrations — and that we're heading toward, if not certain destruction, then at least a planet "much less hospitable to the development of human societies."

This threat is what has cities focused on urban resilience, and preparing for the effects of climate change. Cities have hired **chief resilience officers** to make sure they don't just muddle through the next hurricane or earthquake, but

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